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CLIENT/SERVER SOFTWARE PROGRAM

RESEARCH BULLETINS



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Research Bulletin

A Publication from INPUT's Client/Server Software Program

Vol. I, No. 1

1995

SAP R/3: Where's The Competition?

SAP's Strategy

SAP is a phenomenon. SAP is one of the fastest growing large software companies, providing integrated financial, human resources, sales support and production management software. Its worldwide revenues grew 66% from \$665 million in 1993 to \$1.13 billion in 1994. Its U.S. revenues grew to \$367 million over the corresponding period with a 157% growth rate.

Its R/3 client/server software integrates accounting, production, human resources and sales data for the Global 2000. SAP's goal is to help companies streamline their operations and integrate corporate systems using R/3, its C/S integrated software.

Keys To SAP's Success

From the efficient, modern appearance of its offices, to the high energy of its people, SAP breathes success and vitality. Key values that bring success at SAP include:

- integrity
- partnering
- training - SAP Academy
- focus
- customer service

SAP has a strong public relations program that emphasizes customer success stories. SAP has invested in its partnering program.

At its highest level are Logo Partners. These are integrators and consultants that market R/3. They include the big six accounting firms.

SAP's marketing strategy is aggressive, yet conservative, in that it prefers not to pre-announce its products. It is not afraid to sell its older R/2 product to those that are not ready for C/S.

SAP Academy is a series of courses for integrators, consultants, developers and users that ensures they have the skills to benefit from SAP. It is a rigorous curriculum with pass levels for attendees.

Key Differentiators

SAP's customers buy R/3 to integrate their business across departments and unlike older packages, R/3 is designed to provide seamless integration between modules at a user's screen. SAP is able to build on its R/2 installed base.

SAP is using leverage with its system integrators to get trained "feet on the street" to sell and support R/3. Even with commitments from companies like Andersen Consulting to train 1,000 consultants in 1995, SAP needs to staff its own consulting organization to keep up with demand.

SAP's main focus is on integrating cost-accounting across different departments, using a customer's existing databases and IS infrastructure. For example, Informix and Oracle are supported. Its multi-national and multi-currency support are attractive to global players.

SAP's Architecture

SAP's software supports a three-tiered C/S architecture. Client workstations, application servers and database servers define the three tiers. Many of the application servers run on Windows NT. This approach is increasingly being taken by C/S vendors for large enterprise systems. This is in contrast to two alternatives. The first is to access both applications code and relational databases on the same server, and use a two-tiered architecture. Another alternative is to program the application on a client workstation and keep the data on a second-tier server.

Companies That Don't Buy R/3

With SAP growing so fast it is worth characterizing companies that do not buy R/3. They tend to be companies where the management does not want to make the commitment to a new way of doing business. Their older systems may perform well and management may see no need to redesign their systems.

Cost of implementation is another barrier to the purchase of SAP's software. It is designed for multi-national corporations that require highly integrated solutions. A full implementation can cost \$100 million.

A third class of user that does not use SAP is the company that is content to buy pre-packaged software and does not need integration. When a customer does not have an installed system or is starting a new venture it may be feasible to buy an off-the-

shelf accounting solution that the customer can use with little modification.

A fourth class of customer that is not good for SAP is an Oracle database customer that wants to buy Oracle's Cooperative Applications so that they only need deal with one vendor.

Finally, SAP likes to move fast with its installations. There are some industries where decisions are made slowly, systems are planned with meticulous detail before they can be installed and conclusions are only reached after painfully slow meetings. These sites are often not a good match for SAP's style.

SAP's Markets

SAP is successful in manufacturing, particularly high technology. Virtually every major semiconductor manufacturer is installing SAP's software, in part because of its ability to track detailed costs across multinational boundaries. IBM and Siemens, in the manufacturing sector are typical customers that are installing SAP worldwide.

Oil and gas is another key industry. SAP, for example, is installing its software at Chevron. SAP has not been as successful, to date, in the process manufacturing industries as in discrete manufacturing, especially the high technology sector. Twenty percent (20%) of revenue comes from utilities, universities, city government, health care and services in North America.

Competitors

SAP has many competitors. The most serious of the independent software vendors at the enterprise level being Oracle, PeopleSoft and Dun and Bradstreet. In addition, IBM with ISSC targets enterprise accounts, but will not be discussed further here. Less significant competitors include Computer Associates ASK

division, Coda, Fourgen (based on Informix), J.D. Edwards, Lawson Software, Platinum Software and Ross Systems. Potential competitors include Microsoft, which has the financial resources to extend its product line upward over time. Currently its thrust is with SQL-Server and Line-of-Business objects for applications based on Windows NT. These are likely to be more successful in smaller enterprise and lack the maturity of SAP's products.

Oracle

SAP has a cooperative relationship with Oracle on the database side, but competes fiercely for the applications business. Oracle Cooperative applications has a wide range of modules that includes Oracle Financials, Oracle Human Resources and Oracle Manufacturing. At the end of 1994, Oracle saw some key defections among its applications staff. Applications are not Oracle's main business, hence its sales force is focused more on database solutions, rather than business issues.

Oracle has a technology advantage in that it can know about its database development plans ahead of SAP. In the past Oracle focused on performance and portability of its applications, neglecting the user interface. Oracle's recently released CDE development tool will help Oracle compete with stronger C/S user interfaces. Customers tend to buy Oracle when they want one stop shopping from their database and applications vendor. They will also be more likely to purchase Oracle when they already have Oracle installed or are interested in database performance. Sun Microsystems is an example of an Oracle customer that preferred an integrated Oracle solution.

PeopleSoft

PeopleSoft is an emerging vendor that is growing rapidly, in part because it integrates

standard software components such as Oracle and Microsoft Excel into its products. PeopleSoft has focused from the start on C/S solutions, starting with human resources. As applications become more integrated, PeopleSoft's and SAP's markets are increasingly overlapping. PeopleSoft's strength is agility and a modern architecture. It also has worked with many other software suppliers to leverage its development efforts.

Dun and Bradstreet

Dun and Bradstreet Software is a subsidiary of Dun and Bradstreet Corporation, a company whose strategic goal is to sell information.

Whereas Oracle focuses on the database engine as a core strategy, Dun and Bradstreet focuses on the information stored in its systems. This has caused it to have difficulty in adopting the right technology at the right time. Dun and Bradstreet was, for example, an early adopter of OS/2, then OS/2 did not gain the expected market penetration. Similarly Dun and Bradstreet focused more on the AS/400 proprietary platform than on open UNIX systems.

Dun and Bradstreet was late to the C/S market. Consequently, it has seen software revenues decline. However, it is expected that over the 1996-1997 timeframe the company will rebound as it upgrades its installed base to the SmartStream C/S product line.

Custom Applications Development

The real competitor to a company like SAP for many corporations is custom development from user organizations or system integrators. Companies that already have legacy accounting and human resources systems will integrate them with standard databases.

Exhibit 1

Pros and Cons of SAP and its R/3 product line

	Pro	Con
Company Focus	Main business is applications software.	Needs to continue strong efforts with partners to get early access to database and OS technology on which R/3 runs.
Technology Platform	Early Windows NT adopter, works closely with Microsoft. Customer has flexibility in choosing database.	Has to port code to different environments, increasing support costs.
3-tiered architecture	Simplifies integration with legacy systems, enables SAP applications software to run in known environment.	Smaller companies may prefer a less-complex architecture. Today, SAP is not targeting smaller companies, but over time customers will require a scalable solution.
Services and support	Aggressively hiring more customer service and consulting staff. Strong training for users and system integrators.	R/3 requires significant system integration and support from both its own staff and system integrators.

Source: INPUT

Market Opportunities

According to INPUT's Market Analysis Program, the U.S. market for cross-industry applications software is growing at a CAGR of 14% from 1994 to 1999. The C/S portion of the cross-industry market is estimated to be growing at 26% annually over the same period. The U.S. manufacturing software product market will grow from \$4 billion to over \$11 billion in the same period. This represents approximately 63% of the worldwide market in 1999, according to INPUT's *Worldwide Market Forecast*.

Market Risks

SAP has sold a compelling story to senior executives of multi-national firms. However, integrating R/3 on time and under budget is still a major challenge. Customers usually have such a large application backlog that they are less concerned about short term implementation delays than getting a stable architecture for the long term.

Currently many customers want flexibility. They do not want to get locked into Oracle or

any other software vendor, as happened with IBM in the mainframe market. This sentiment could change.

INPUT Assessment

SAP has a very strong market position and has developed relationships with major system integrators and global corporations. Its vulnerability comes from competitors that can provide solutions that require less support and integration. The most likely source of this competition short term is Oracle.

SAP has leapt ahead of the competition with savvy marketing and a strong product line. It could easily be a \$5 billion company by the end of the century.

Further Information

For details on the implementation details on the information service markets surrounding SAP see INPUT's Research Bulletin from the Systems Integration and Professional Services Program. For more details on SAP America see INPUT's Vendor Analysis Program profile.

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Research Bulletin

A Publication from INPUT's Client/Server Software Program

Vol. 1, No. 2

1995

FLASH!! - IBM Acquires Lotus for \$3.5 Billion Cash!

IBM's Fast Reaction Time

In a Monday, June 12 announcement, IBM and Lotus stated that their one week long whirlwind courtship had ended, and that Lotus had agreed to be acquired by IBM for \$64 a share—a total of \$3.52 billion in cash.

One surprising announcement by IBM was that Lotus chairman Jim Manzi would be part of the deal, and would be both Lotus' CEO and an IBM senior vice president. This surprised many industry observers who assumed that Manzi, like most "acquired" CEOs, would "move on" to other opportunities. He didn't. He's staying.

The deal, which is not, at this time, being challenged by anyone (including the U.S. Justice department), has many implications for the personal computer industry—topics such as what this means to the future of IBM's OS/2 Warp (vs Microsoft's Windows) and what an IBM-sponsored Lotus Notes product will do to the market for Microsoft's Exchange groupware. As further details of the acquisition are revealed, these considerations will be addressed in greater detail in a subsequent INPUT research bulletin.

Exhibit 1 summarizes INPUT's recent forecasts of the worldwide market for Lotus Notes and related services.

Exhibit 1 Worldwide Market For Lotus Notes and Related Services

	1994 (\$M)	1995 (\$M)	1996 (\$M)	1997 (\$M)	1998 (\$M)	1999 (\$M)	CAGR% 94-99
Software including Notes, Add-ons & 3rd Party Applications	680	890	960	1010	1150	1380	15
Professional Services	180	270	320	360	350	390	17
Systems Integration	440	790	970	1300	1410	1540	29
Network Services	20	160	310	480	690	890	107
TOTAL	1320	2110	2560	3150	3600	4200	26

IBM's Reasoning

Prior to finalizing the deal, IBM invited INPUT and a number of other consultants and industry professionals to join in a teleconference to hear IBM's announcement, reasoning and plans for the Lotus acquisition directly from IBM senior executives.

Exhibit 2

Exhibit 2 summarizes the comments made by IBM's John Thompson, senior vice president, Steve Mills, vice president of Software, and James Corgel, vice president of Consultant Relations, regarding strategic advantages of the acquisition for IBM.

Strategic Advantages for IBM

- Good channels - IBM will gain strong third party and retail channel management, as well as strong relationships with over 3000 software applications providers
- Robust messaging infrastructure which provides a way to loosely couple applications across enterprises
- More products to go head-to-head with Microsoft
- A Notes-based business culture that is very efficient and productive, as well as thousands of talented Lotus software developers
- Strong brand image and extensive desktop skills

Q & A

Following IBM's comments, the teleconference was opened to questions from conference attendees. INPUT feels that the questions posed by the participants offer an excellent summation of industry concerns regarding the future of IBM's software strategy and also where it is going with OS/2 WARP and groupware. There is obvious interest in IBM's strategy for dealing with Microsoft—both in the operating system and applications software arenas. INPUT's selection of the questions and responses that we feel are most enlightening follow:

Q: What are IBM's plans for other desktop products from Lotus?

A: All of Lotus' other products support the match with IBM. Mail is very important.

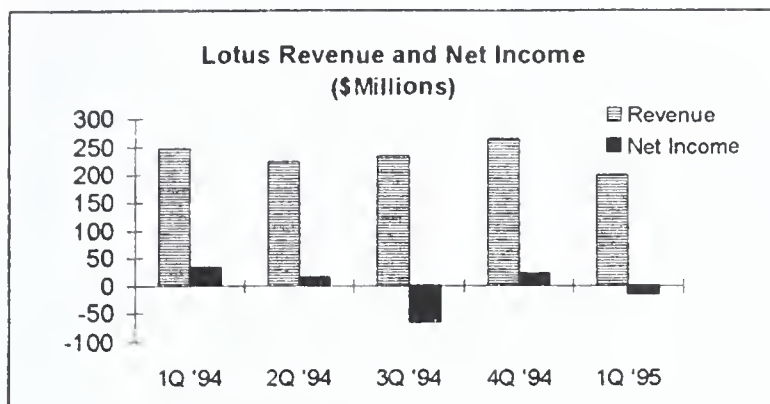
Active investment in the public network side of Notes and also in the consulting and fee services are all complementary areas to IBM. Lotus has a strong position in desktop products with Lotus SmartSuite and this is complementary to IBM's Client/Server and network centric focus.

Q: Lotus' Applications division is going downhill and Lotus Notes revenues slowed during 1Q this year. Would it not be better to sell off Applications and concentrate on cc:Mail and Notes?

A: We are interested in all aspects [of the desktop business] and it is premature to discuss detailed strategies. There are no thoughts of selling off the applications business at this time. Lotus will continue to invest in the suite area.

INPUT note: See Lotus' financial performance summarized in Exhibit 3.

Exhibit 3



Source: Various media

Q: Do you foresee a cultural clash between large IBM and smaller, more entrepreneurial Lotus?

A: If we are successful in getting 100% of the shares, IBM wants to keep talent, spirit, and desktop knowledge with Lotus. IBM would like Lotus to handle groupware products being developed in IBM, and IBM likes Lotus' channels. IBM would give Lotus autonomy over this [area] and they would run these businesses out of Cambridge. This is a different IBM, we want to accelerate the growth, and we want to use Lotus' talents and people.

Q: I have used SmartSuite for OS/2. Will Lotus applications be used for OS/2 WARP as part of that product line?

A: IBM will go with all platforms— this is a strength of SmartSuite. We want to continue with this focus, and OS/2 will be one of the platforms.

This is about client/server and networks, not about OS/2. We will support all of the existing relationships.

Q: Has IBM spoken to the Department of Justice (DOJ)?

A: No. But, IBM is optimistic, based on its legal counsel. They have made a call to justice.

Q: I can hardly imagine DOJ opposing this move. Can you confirm that this may disintegrate into a hostile takeover? Many mergers end up ruining the acquired company. How will Lotus manage itself? What happens if Lotus has different views on future products?

A: IBM has great respect for Lotus and prefers not to view it as hostile. IBM hopes this will be [a] very friendly [acquisition]. This has come about because we have not been able to have fruitful negotiation. The intent is to have a friendly deal. IBM has been associated with some unsuccessful deals, but in this case they can help Lotus, they can keep an open focus, and have Lotus run the area they know best, with access to IBM resources. This has been studied hard - IBM knows the do's and don'ts here. IBM is not prepared to answer questions on future strategy, it is too early to comment.

Q: IBM middleware is available on other operating systems. This is always after IBM has put it on its own operating systems. Will this become true for Lotus? Will this impact Oracle and other database vendors?. Can groupware be sustainable aside from Notes at IBM? How do we rationalize IBM groupware?

A: IBM can get to a common basis of programming and can be cross-platform. Lotus has to be driven by the market. Oracle, Sun, HP and server vendors will

be OK because Notes is an open platform. This is a strength of Lotus's that will be fostered with IBM. IBM is in the software business for software's sake. IBM has personally placed calls to these companies to assure them of this point.

At Comdex in November we explained how IBM's groupware complements Lotus Notes; customers are already using both together. These will mesh together well, both now and in the future.

Q: What message will you give key employees at Lotus to keep them with IBM and reassure them? Are there any specific plans? Word coming out of Cambridge, based on our quick phone around, is that Lotus employees want the \$64 for their shares and will take the money and flee.

A: IBM will make appropriate communications. Through many different channels we will let them know we value their talent and strength and that IBM wants to preserve Lotus, not pull it apart.

Q: How much of this acquisition is pre-emptive—to stop someone else from acquiring Lotus—and how much does this signify a trend towards additional acquisitions by IBM?

A: We put a fair price on the table and we've studied what they think the company is worth. IBM's growth will come from acquisition as well as from more products.

IBM is not precluding other acquisitions or saying they will not do other things. IBM wants leadership in this area—client/server and network-centric

computing—and will do whatever it takes to get it.

Q: Was timing a key determinant in this unsolicited bid? Did you see Microsoft not coming out with groupware soon enough?

A: We have had a comprehensive review of strategy and of various alternatives for achieving it. We saw no reason to wait, so we've moved now. We pulled IBM software into a single strategy at the beginning of this year. Lotus has good channels, wonderful relationships with over 3000 software applications providers, a strong brand image, is number two in the desktop area, and is a popular e-mail client—all [attributes] are of interest to IBM.

Q: With IBM's investment in the IBM Global Network, will Lotus be able to continue to partner with other network vendors like AT&T on Network Notes?

A: Notes runs on different operating systems, different networks; it is collaborative and independent. We already called AT&T and told them we are committed to the public networking companies support of Notes, in particular the telephone companies. We are committed to making Lotus Notes an open platform and will support and foster the AT&T relationship and other moves into public networks.

Conclusions

IBM has done their homework on Lotus' products and markets. However, the marketplace appears to be concerned and somewhat skeptical of IBM's understanding of Lotus' entrepreneurial culture which has made them successful.

IBM's poor track record working with smaller firms has caused many Notes customers to express concern. Although the deal gave Lotus an independent structure to preserve its corporate culture, INPUT expects that there will be considerable growing pains as Lotus is assimilated by IBM.

The Lotus acquisition, the largest software acquisition in history, is a strong indication of the wave of vertical integration that is growing in the computer industry. INPUT expects the frequency of acquisitions and mergers within the IT industry to continue at a robust pace. Exhibit 4 illustrates recent software acquisitions—and offers an indication of the size of the deals being made and the stature of the participants.

Exhibit 4

Recent Large Software Deals (\$M)

Company	Acquired By	Deal Value	Year
Lotus	IBM	\$3,500	1995
Legent	Computer Associates	\$1,780	1995
Powersoft	Sybase	\$875	1995
Wordperfect	Novell	\$855	1994

Source: Various media

IBM is the largest software company in the world and virtually the only company that can pose a formidable challenge to Microsoft. The battle for the groupware market should turn up a notch as Microsoft prepares to release Exchange.

In addition, all eyes will be on Jim Manzi (who will be staying on as an IBM senior vice president and as Lotus chief executive) and John Thompson, IBM senior vice president. The acquisition adds significantly to Thompson's responsibilities and makes him much more visible. If he is successful in bringing Lotus onboard with IBM, and using each company's distinct strengths to fulfill both company's business objectives, he may be well positioned to become IBM's next CEO.

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Research Bulletin

A Publication from INPUT's Client/Server Software Program

Vol. I, No. 3

1995

Service Beats Marketing On The Internet

Introduction

INPUT's report on emerging Internet applications suggests that the Internet will affect most business functions by the year 2000. The Internet will be a leading network infrastructure for supporting third generation client/server applications that span corporate boundaries. The Internet is frequently positioned by pundits exclusively as a sales and marketing vehicle. INPUT's research contends this view is myopic.

INPUT's initial Internet survey was limited to major North American corporations. To qualify for the study, respondents had to be either currently active or planning a presence on the Internet. Respondents were asked to rate on a 1-to-5 scale, with "5" being "significant impact," the expected Internet impact on corporate business functions.

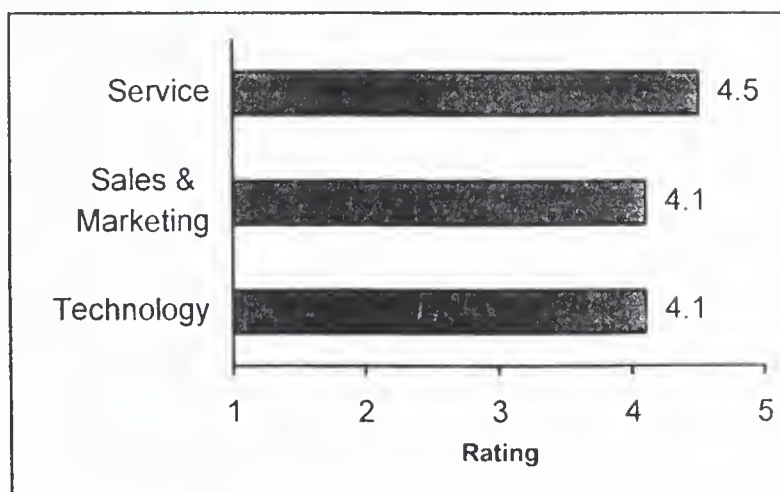
The respondents rated the impact of the Internet on each activity at a rating of 3 or higher, with some rating "significantly" at 5. As seen in Exhibit 1, the impact of Internet on corporate sales and marketing functions was equaled or surpassed by that on technology and service. For the three functions shown (i.e. Service, Sales and

Marketing, Technology), over 75 percent of the respondents rated the impact as "4" or "5.

Electronic marketing may be hot, but electronic service and support are even more important. High technology companies have used bulletin boards, online services like CompuServe and the Internet for technical support for years. Now Federal Express is using the Internet for tracking packages.

Exhibit 1

Business Functions Most Impacted by the Internet



Source: INPUT

1="No Impact"
5="Significant Impact"
48 Respondents

Exhibit 2 indicates the rating for all the categories of applications. The primary activities (i.e. in-bound logistics, operations, etc.) were all rated somewhat higher than support activities, except for technology, which was rated at or slightly above average. Respondents expect the Internet to play a

major role in the activities of their corporation. The Internet will be especially important in managing the supply chain and downstream sales. Leading edge companies are already basing some of their internal corporate applications on Internet technology, but the majority see this as a lower priority.

Exhibit 2

Business Functions Impacted by the Internet

Type of Application	User Rating of Impact 1=No Impact 5=Significant Impact
Support Applications:	
Corporate Infrastructure—general management, including planning, accounting, and legal	3.0
Human Resource Management—recruiting, training, developing and compensating personnel	3.2
Procurement—purchasing raw materials, supplies, and other consumable and non-consumable assets	3.3
Technology—knowledge and tools used by the company	4.5
Primary Activities	
Operations—transforming inputs into the final product form; packaging, assembly, testing, printing etc.	3.1
Inbound Logistics—receiving, storing, and disseminating inputs to the product such as warehousing, inventory control, scheduling, returns to suppliers	3.4
Outbound Logistics—collecting, storing, and physically distributing finished goods; warehousing, materials handling, order processing, scheduling	3.5
Sales & Marketing—inducing buyers and providing a means for purchase; advertising, quotes, channel selection, channel relations, pricing	4.1
Service—after-sale support such as installation, training, product enhancements, customer service	4.1

Source: INPUT

How will the Internet impact these company functions?

Below are some of the ideas from respondents on how their business would change with the Internet.

Support Functions

- *Firm Infrastructure*

Companies who see the impact of the Internet on their business operations face dramatic changes across their entire organization. If Internet lives up to its full promise then power structures shift and an organization's virtual location on the "net" becomes more important than its physical location. Instead of prime real estate near an airport, a company may need an attractive Worldwide Web site connected to industry leaders. Virtual employees in a cyberspace community will form their own electronic relationships through joining appropriate interest groups, corresponding with business partners and promoting their own information electronically. Already, engineers at companies like Sun Microsystems and Silicon Graphics are creating their own publishing materials on internal Internets.

Companies realize the benefits of gathering competitive intelligence and setting strategy. Here are two examples:

- eWorks!, (White Plains, NY) tracks the comments made about a company on Internet.
- Herring Online (Woodside, CA) is a monthly electronic magazine covering technology strategy, finance, and investment that plans to start a virtual stock exchange for privately held high-tech firms.

Many companies that track readers of their Worldwide Web pages, find their competitors the heaviest browsers. An Internet presence is a two-way street--access and exposure--that affords the third-party, the competitor, an easy means to volumes of data on a given company. Besides information available on a company's Internet server, there are newsgroups for exchanging (competitive) information and electronic mail access to an audience so sizable that, by definition, it would include individuals with competitive intelligence. On the more sinister side, non-secured electronic messages may be subject to interception.

- *Human Resources*

Some companies believe the Internet to contain a vast pool of talent that must, by its sheer size, include individuals with the exact requirements the company needs. Moreover, attracting these individuals should be easier than today's conventional employment vehicles (e.g., "Help Wanted" advertisements or head hunters); simply announcing positions on a home page and accepting electronically mailed resumes will shorten the process and cut the expense of recruiting.

On-line, distance training is another HR application soon to emerge on the Internet. Imagine full-featured courses that offer still and motion graphics, hyperlinks for greater understanding of material, and real-time access to a subject matter expert. All of this at a fraction of the cost of live instruction.

- *Procurement*

Surprisingly, finding suppliers and ordering supplies was not rated as a higher impact area. It may be that companies are still uncomfortable with the

extra amount of faith currently required in electronic buying or that companies are waiting until payment systems and security issues are of less concern. Still, procurement from a truly global market could be attractive to many companies. Premenos is a company promoting solutions for electronic commerce over the Internet with customers such as Cisco and NASA.

One area that has been growing is on-line travel planning and ticket sales. For example, users now have access to American Airline's Easy Sabre, Delta/TWA/Northwest's WorldSpan TravelShopper, and Independent OAG for information and ticketing (the actual ticketing is currently handled through selected agents).

- *Technology*

The Internet will create a major impact on corporate technology. Employees need tools and methods to access the Internet as easily and as transparently as they access the LAN now. The Internet will drive demand for more powerful desktop computers and greater bandwidth. If the Internet becomes as ubiquitous as some companies envision, this technology upgrade will be massive.

The Internet also offers a global R&D laboratory for product testing, feedback, and learning of customers' needs and requirements.

Primary Activities

- *In-bound Logistics*

Companies see a day in the near-future when at least the administration of in-bound logistics will be handled via the Internet or its next-generation

equivalents. Electronic data interchange (EDI) continues to grow and the Internet will become one vehicle for clearing supply orders and other inter-company communications. Alternatives will include online services and private EDI network services. The value-added network suppliers will continue to have a role, particularly for bulk transactions and legacy applications.

- *Operations*

While control over operations such as manufacturing may eventually involve the Internet, most respondents see only an ancillary role, especially for tangible goods. There are exceptions, however, in such areas as publishing where Internet will be the operation. Custom publishing with selected materials in a selected order will become more common. Some specific examples:

- Trane (La Crosse, WI) uses the Internet to cut the paperwork of custom-built heating and air conditioning units, saving 35% of the cost.
- New Century Network is a consortium (Advance Publications, Cox Newspapers, Gannett Co., Hearst Corp., Knight-Ridder, Times Mirror Co., Tribune Co., The Washington Post) that will share content and jointly develop new services. The consortium will provide technical standards, and consulting services and develop national e-mail, bulletin boards, and chat networks.

- *Outbound Logistics*

Management of logistics will be a key application of Internet for many producers of goods and services, but only non-

tangible services will likely benefit from the actual distribution capabilities of the Internet. Still, with such things as voice traffic appearing on the Internet, it will not be surprising if someone develops a method for virtual manufacturing with the Internet at the core. Advanced search capabilities and database interfaces, based on technologies from companies like WAIS, Verity, Illustra and Infoseek will be used for applications like billing, registration and ad tracking.

Three companies that are busy reaping the benefits are:

- Hewlett-Packard has 30,000-40,000 printed items to describe its 20,000 products. The Internet allows them to store only one description and to provide an instant updates to all readers instead of having to recall old versions of printed documents.
- Sundance Catalog (Park City, UT) automated their logistics system; including a color, electronic catalog, credit checking, inventory updating, accounting, and shipping management. In using on-line services their cost/order dropped from \$10 to \$4.
- Shoppers Express (on America Online) lists 10,000 grocery items from which users can select for free or almost free (\$12) delivery to the home.

• *Sales & Marketing*

Advertising and promotion are the two big applications of the Internet's Worldwide Web presently. This is due in part to corporate America's rush to exploit a new medium and fill the content void with advertising. This is also due to the current phase of customer driven marketing. The impact of Internet sales and marketing on

the corporation will continue as Internet offers access to an ever-increasing global marketplace—with currently very attractive user demographics—with minimal costs per contact.

The Internet promises to change the nature of the relationship between supplier and consumer. Already there has been a movement away from advertising and to promotion—from “pushing” goods and services to inviting consumers to “pull” them.

The Internet, especially the World Wide Web, is an inexpensive way to offer information about company and its products. Some companies and their sales and marketing activities include:

- Dealernet (Seattle) has a Virtual Showroom to market cars and other products. Information includes technical data, pricing, and comparative data. No orders are taken, but users are directed to dealers. One dealer reported four sales in the first 90 days.
- ABN (Fogelsville, PA) links outdoor billboard companies with suppliers, agencies, and buying services and gives them statistics, rates, and images of outdoor sites.
- Virtual Vineyard (Los Gatos, CA) uses has software to track customers, hoping to establish the kind of electronic relationships that resemble those conducted in live stores.
- Digital Equipment Corp. lets users try out how fast Digital's Alpha-based computers can run their programs.

- *Service*

Sales support, a significant means of competitive differentiation, is a natural for the Internet. By providing customers with easy access to massive amounts of technical data, product updates, and general support notes, companies have an opportunity to cement relationships as never before. Accurate information will be available to customers quickly and at little cost to the company.

Refunds and returns, "bug" reports, conferences and messages, and product knowledge databases are becoming more widespread on the Internet. Here are two examples:

- GE Plastics has 1,500 pages of technical literature on-line. Their purpose is to provide 24-hour access and reduce the cost of answering inquiries.
- Vanguard, Montgomery, and Fidelity Investments all offer investor services (education, account information, interviews with fund managers, prospectuses, and message boards for sharing ideas.

Conclusion

High technology, research and engineering corporations have used the Internet with commands such as gopher and ftp, the technology is now impacting all industry sectors. There are many companies where electronic mail is preferred for communications over the phone system. The recent excitement in Internet applications has come because visual user interfaces and inexpensive services have made the Internet useful to other industry sectors.

Using the Internet for electronic mail in the mid-80s, in part, enabled companies like

Oracle and Sun Microsystems displace established competitors. Up to now the Internet has been a silent competitive weapon, now it is being recognized, if implemented appropriately, as a major business advantage. The Internet will create new companies that can compete with efficient information systems infrastructures. The Internet architecture, seriously weak in places, will evolve, security being a major thrust for new software development at present.

Widespread acceptance of the Internet across business functions will result in:

- the growth of shared applications across corporate boundaries
- more rapid change and an accelerated pace of business
- a larger gap between those that know how to invest in and use Internet technology and those that only partially embrace it
- companies being divided into trading groups that use similar communications technologies

The use of the Worldwide Web is one facet of third generation client/server computing that links corporations with messaging technology. The Internet will increasingly support objects, agents and multimedia experiences. The applications cited here are early examples of how companies are using the Internet. Time and creativity will dictate the growth in number, spread of use and variety of applications.

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Research Bulletin

A Publication from INPUT's Client/Server Software Program

Vol. 1, No. 4

July 1995

Will PC Vendors Support the Enterprise?

Enterprise Trends

Software product support is a major issue for users and vendors. The increasingly popular LAN-based client/server architectures are dramatically increasing user support costs because many vendors are changing their pricing structures to usage based pricing. This coupled with increased usage, translates into increased expenditures for software support and related services.

The move away from proprietary solutions, toward open systems architectures, increases the need for software vendors to provide multivendor product integration and supporting software services.

Many vendors, at all platform levels, are creating incremental revenue streams by separating software product-related services into alternative revenue categories, such as professional services, systems integration, and outsourcing. Professional services usually includes consulting,

application development, and training. Several of these services are growing much faster than the traditional software support market, which has provided bug fixes, maintenance, and upgrades.

There are two distinctly different attitudes of software companies towards support:

- Established mainframe and minicomputer software companies with direct sales forces often cannot survive without lucrative maintenance contracts
- Many larger PC software vendors have unbundled software support services from product license fees, and instituted support charges based on support-level complexity

Exhibit 1 summarizes the current trends in enterprise software support.

Trends in Enterprise Software Support

- Pay for support as you need it
- Less sophisticated users
- Greater use of third party support
- Unbundling of services and pricing
- Introduction of tiered pricing
- Increased use of technology in providing support and services

Source: INPUT

Technology Trends

All levels of software product vendors are introducing more automated technology, such as electronic bulletin boards, into the customer support function to reduce personnel costs. Such practice changes by the software product vendors have helped slow the rate of profit margin deterioration. Many vendors are also using electronic software delivery to reduce manufacturing and distribution costs.

Exhibit 2 illustrates technology which is being used by vendors in providing support and services.

Technology Applications in Software Product Support and Services

- Remote software distribution, remote diagnostics
- Voice services (800 numbers, 900 numbers, help desks)
- Image/fax services
- Remote printing
- Electronic Bulletin boards
- Automated customer information response systems- problem resolution databases
- Internet-based documentation
- Internet-based training

Source: INPUT

Pricing of Support Services

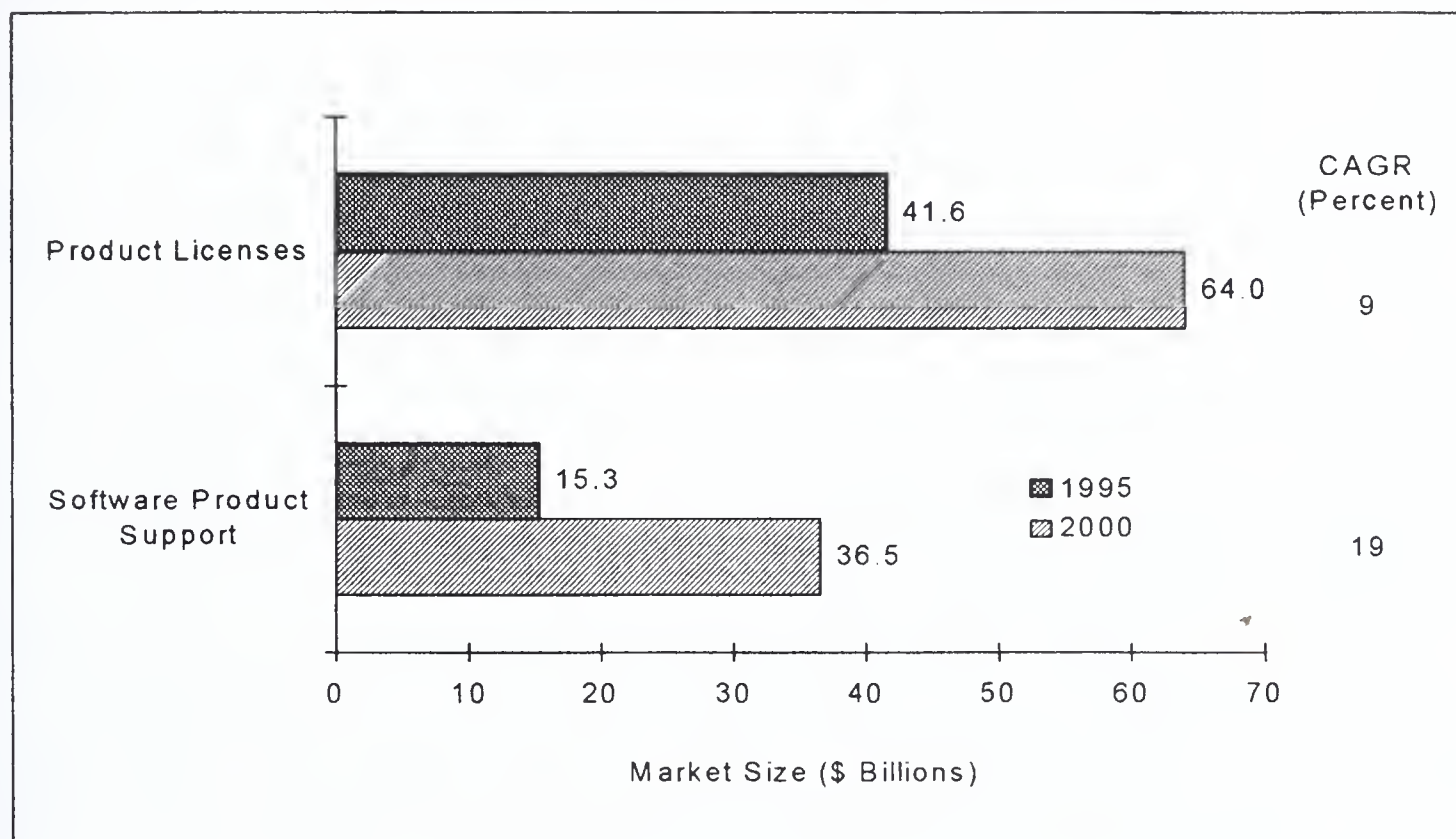
As PC vendors sell centrally into enterprise IS departments with volume discounts, a major issue is how to price support services and maintenance.

Established mainframe software vendors typically charge maintenance as a percentage of the software product license price. The desktop software industry's support services model is based on a combination of the cost of delivery of support and usage of support. Thus, the price of a support contract for licensed software will vary widely depending upon the type of software and support level complexity.

INPUT's research indicates that new maintenance contracts revenues typically average between 15% to 20% of the software product license fee, for software vendors as a whole.

The relative size and growth rates for U.S. software products and related support services are shown in Exhibit 3.

U.S. Software Products and Services, 1995-2000



Source: INPUT

Selected Vendor Strategies

Many software vendor support policies vary depending upon the level of service, rather than following a discrete formula based on a percentage of the purchase price. Following are some examples of vendor support services programs which were selected to show a variety of different approaches.

Microsoft

Microsoft is the definitive PC software vendor model. In 1993 Microsoft introduced a fee-based support pricing policy along with tiered support pricing. Microsoft segmented its customer service offerings, following an assessment of various support requirement levels of its customers.

Support service levels are:

- **Premier Comprehensive, Premier Development support or both**
 - For mission-critical and development/OEM environments
 - Includes a designated technical account manager who can also provide customized support
 - Covers all product groups
 - Includes toll-free 24x7 access
 - Premier's Comprehensive base price is \$20,000/year and Premier's Development charges a \$20,000/year flat fee
- **Priority desktop support**
 - 800 and 900 number, 24x7 access

- Available for all customer's products within each product group
- Fee options indicated in the initial announcement were a \$195 annual fee, a \$2-per-minute phone charge or a flat \$25 rate per incident for desktop applications and/or operating systems
- **Standard Support**
 - Basic level of technical support
 - Unlimited for applications; 90 days for personal operating systems and development tools
 - Toll telephone charges
- There are also extensive support services from third party providers.

Lotus Development Corporation

Lotus recently announced it is scaling back its free support and adding several new fee-based support programs for its Notes and cc:Mail products. Free support for Notes and cc:Mail was reduced from 90 to 30 days and will also require a toll charge to access.

A new communications program gives Notes sites access (via Notes) to the technical information database used by Lotus technicians for \$20 to \$50 per month. User sites can access a dedicated senior support analyst for \$35,000 per year.

Adobe Systems Incorporated

In addition to its free support programs, Adobe provides a series of extended support programs.

- **Three levels of ASC support prices range from \$25 to \$175**
 - For the highest level, 10-ASC, the Adobe Technical Reference CD is included free. This disc includes: Adobe technical notes, Adobe Acrobat Exchange, which allows the user to view and print the technical notes and share PDF files with other Acrobat users; and the Adobe Type Browser, an on-line catalog for viewing and printing Adobe typeface samples before purchasing.
- Adobe also offers (900) 555-ADOBE, which provides infrequent users with help from an Adobe Technical Support representative. This 900 service is \$2 per minute plus any toll charges.

Conclusions

The complexity of software support is increasing, particularly for products based on a distributed architecture. This architectural transition is changing the nature of software support services requirements of both vendors and users.

Many vendors are responding with a number of new support programs, including the introduction of fee-based pricing; often with a tiered, value-added structure. For those vendors who have offered bundled consulting, development, and training services and maintenance contracts, a trend has been to unbundle the various components of the maintenance program.

Vendors of PC software products are more often using third-party support

services from outsourcing and third-party maintenance firms.

Support services pricing has increasingly become a competitive issue among minicomputer and mainframe software product vendors. Multiyear licenses at pre-determined rates and unbundled pricing of various support services have become popular alternatives.

The markets for software technical support and other types of software related services are expanding at rates greater than many of the markets for software products.

Recommendations

The higher growth software market opportunities over the next five years will continue to shift from software product to complementary software services and solutions.

As summarized in Exhibit 4, there are several keys to success in software product services markets.

Exhibit 4

Keys to Success in Software Product Services

- Automate support technology
- Be sensitive to customers
- Provide broad-based services
- Support standards
- Provide cross-platform software management tools
- Partner with companies that provide broad software product services offerings

Source: INPUT

Software product vendors should re-engineer their customer support services to include electronic support and delivery. Automated support technology will enable vendors to minimize the personnel needed to support lower margin products. Vendors should concentrate more expensive aspects of support, such as software engineering personnel, on supporting more complex, higher value software products.

PC software vendors should consider using third-party firms for at least part of their cross-vendor product support requirements. For larger corporations that have the resources to support multivendor products, consider expanding into desktop services outsourcing and take advantage of this market that INPUT estimates to be growing at a 25% compound annual growth rate.

Software product companies should also partner with companies that provide broadly-based software services offerings to maximize synergies of product and services solutions sales.

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Research Bulletin

A Publication from INPUT's Client/Server Software Program

Vol. 1, No. 5

July 1995

3rd Generation Client/Server Systems Emerge

Corporations Define New Boundaries

Client/server technology is forcing corporations to redefine their boundaries and reach out to customers and suppliers. A major thrust of corporate reengineering efforts is to accelerate business processes using client/server technology. Companies have reduced ordering times from weeks to hours.

How companies implement their software is dictating with whom they can trade. Some companies refuse to deal with suppliers who cannot provide information in specific formats. For example, a retailer was faced with a supplier who demanded that five separate purchase orders be created to order one category of products for separate regions of the country. When the retailer would only cut one purchase order the supplier was forced to make major changes to its ordering systems.

What Are Third Generation C/S Systems?

To link corporations effectively the third generation of client/server systems is evolving (see Exhibit 1). These three generations of systems co-exist. The **first generation** is relatively simple with all client platforms having the same architecture, usually they are PCs running Microsoft Windows. A single server supports the application, often running a relational database, but alternatively it could support a flat file, engineering or computational application.

The **second generation** is where mainstream client/server systems are being installed now. These support heterogeneous networks with multiple databases and multiple clients. They typically go beyond workgroup computing to support a site or enterprise. Forté, Seer Technologies, Compuware (with Uniface) and Dynasty are just a few of the many software companies providing application development tools for this market.

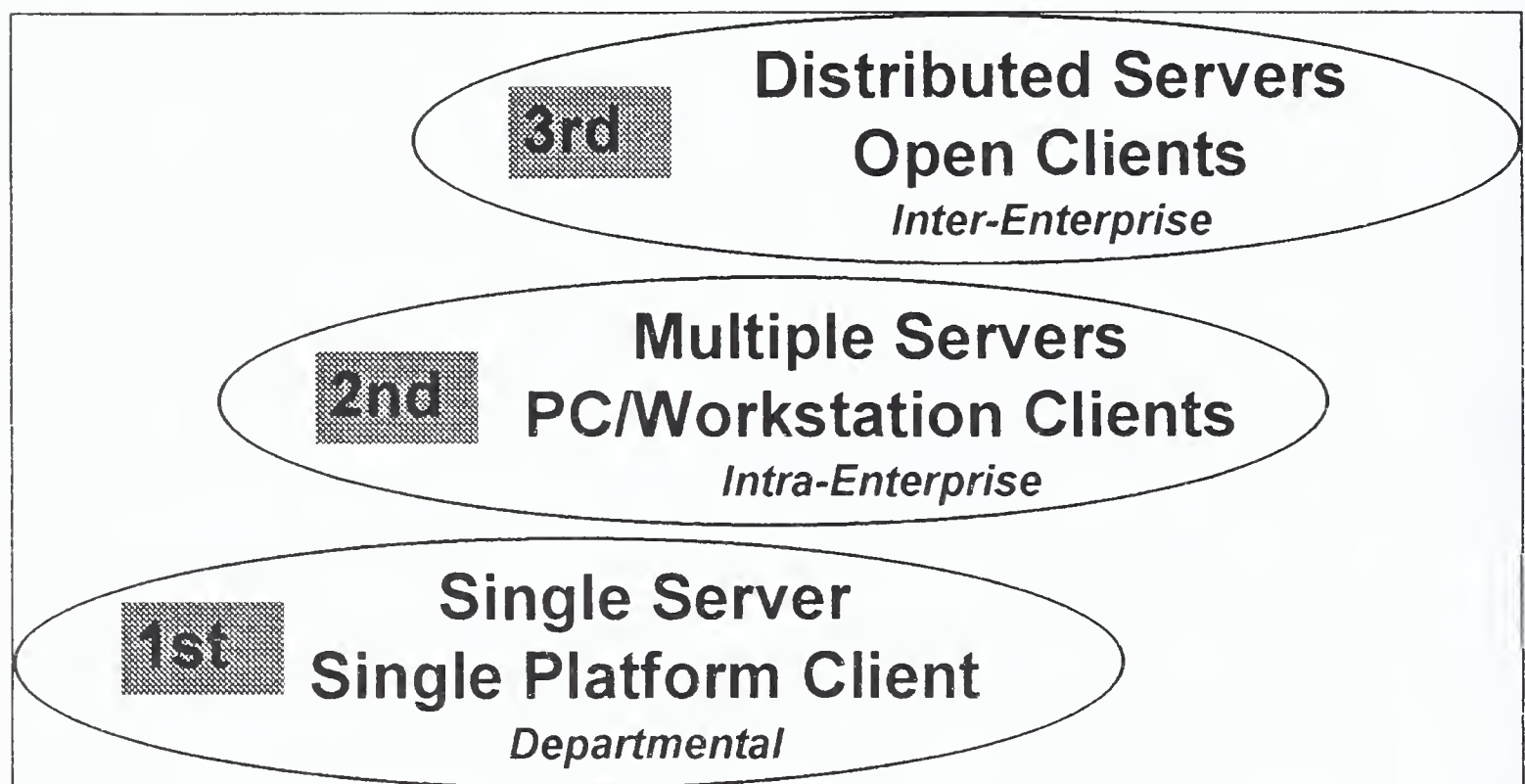
Established vendors, like IBM, provide solutions for specific cross-platform applications using their own tools.

Third generation systems are where industry leaders are starting to gain competitive advantage by accelerating business processes and configuring flexible applications. Third generation

systems support a wide range of client software making them suitable for applications to run across enterprise boundaries. They are typically based on object-oriented messaging technology that loosely connects user applications to server systems, that may include databases, mailboxes, files and documents.

Exhibit 1

Three Generations of Client/Server Systems



Source: INPUT

Where Are Third Generation Systems Found?

There are four main areas for third generation systems:

- mobile computing
- World Wide Web (WWW) applications
- Lotus Notes applications
- electronic commerce

In mobile computing, AT&T's Personalink service has many characteristics of a third generation client/server system, but lacks the ability to support a wide range of client software. The underlying infrastructure uses General Magic's object-oriented Telescript language that sends agents across a network between server and client. Currently the client software runs on Motorola and Sony personal communicators, but General Magic

expects to make it available on PCs and Apple Macintosh computers.

WWW applications have the advantage that they can be created entirely on a server. Client software ranges from text-based LYNX to Netscape's popular browser that supports secure transactions across the Internet. The WWW uses both hypertext and forms-based user interfaces to enable users to view and hear information. Federal Express has a WWW application that allows users to track shipments, download software and request package pick-up.

In the **Lotus Notes** area, Egghead Software is one of several companies using AT&T's Network Notes to support its sales process. INPUT estimates that the software market for Notes and applications based on it will grow from \$900M in 1995 to \$1.4B in 1999, with a CAGR of 15%. The corresponding services market, including systems integration, professional services and network services, is expected to grow from over \$2B in 1995 to over \$4B in 1999 with a CAGR of over 25%.

Electronic commerce vendors are leaders in developing applications that cross enterprise boundaries. Swedish-based Frontec, with a strong presence in the UNIX market, has developed AMTriX, a messaging infrastructure that supports EDI and electronic commerce applications. Harbinger is another EDI vendor broadening its product line to support more messaging applications.

What Are The Database Vendors Doing?

To leverage sales, software vendors need to identify partners to provide complementary products and services. All the major database vendors are actively pursuing the integration of their systems with messaging infrastructures. All the major databases have interfaces to the WWW and have messaging strategies. This is because the tight integration of client and server is unworkable in large, complex networks and a messaging infrastructure is easier to manage. Informix has formed alliances with Frontec and Netscape. Oracle has an interface called Oracle Agents that can send data over wireless networks. It can be used by Oracle Power Objects, an application development tool, to integrate it with other applications on the desktop. Sybase acquired Complex Architectures in February for its Enterprise Messaging Services technology that integrates database components via wireline and wireless networks.

How Is Development Changing?

Development is swinging from being focused on the user interface using visual development tools, like Powersoft's PowerBuilder, Microsoft's Visual Basic, Gupta's SQL Windows and ParcPlace's VisualWorks, to being focused on the server. Emerging vendor USoft, funded by Unisys, is promoting server/client computing that focuses primarily on systems design and server functionality. User interfaces can readily be customized later in the process. A server-centric approach to developing client/server systems has the following advantages:

- user interface standards are easier to implement
- central organizations can have control
- systems tend to be easier to scale

The WWW is the ultimate server-centric environment where a web programmer need have no knowledge of the client software. Leading edge corporations are looking to web-like architectures for their internal IS systems so that they do not have to support client system programmers.

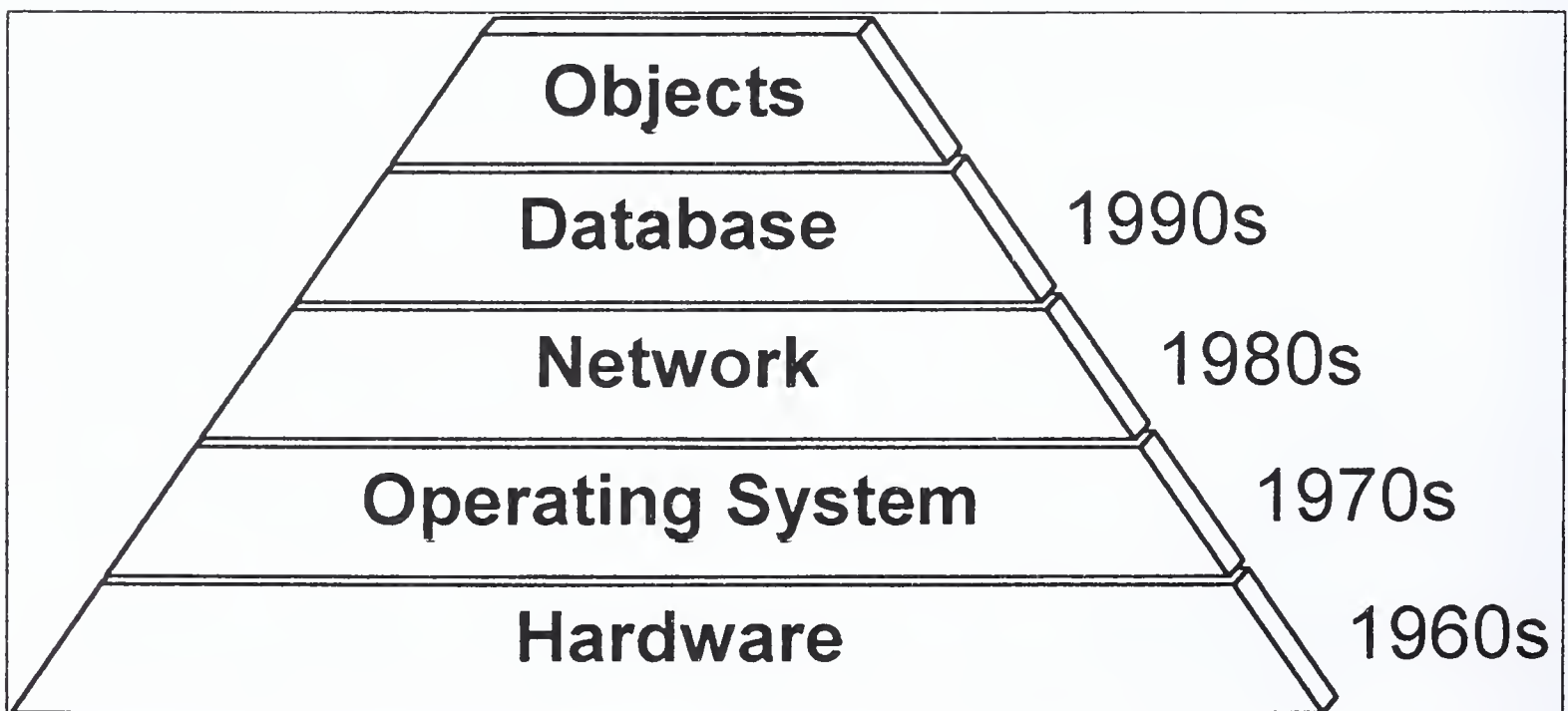
Another trend in development is towards objects and component software. Components may include spreadsheets, reports, files or documents. They may also include low-level objects used by programmers, like scroll bars and icons.

The level at which users get locked into software is changing from databases to objects as Exhibit 2 shows. In the 1960s programmers wrote in assembler designed for specific hardware. By the 1990s, the database was added to the list of platforms that a user can get locked into. For the next five years, objects will be the key area that users can be locked into. Who owns the object layer is not clear. It may be Microsoft with OLE, but it may also be an emerging vendor like Taligent.

Another scenario is that there will not be a universal object infrastructure and that separate subsegments of the software industry will support their own architectures. For example, in systems management there are several object-oriented infrastructures emerging from companies like Computer Associates, Candle and Compuware.

Exhibit 2

The Computing Platform Is Migrating To Objects



Source: INPUT

Security

Security is a relatively recent addition to messaging infrastructures. Demand for security is fueled by increasingly serious threats. Credit card number threat from Internet access provider Netcom by Kevin Mitnick illustrates the threat posed by hackers. Public key encryption technology, from companies like RSA Data Security, may be used to authenticate users and transactions. As companies connect with messaging infrastructures they need to protect their systems with firewalls. Firewalls enable specific types of information to pass in and out of a corporation. Unlike traditional systems, where security is provided in an application or database, third generation client/server systems will rely on the messaging infrastructure or other middleware to provide security.

Where Are The Markets?

The main markets for third generation client/server systems are in:

- banking
- retail trade
- telecommunications
- health services

The banking industry, in general a late comer to client/server computing, is now

embracing it enthusiastically as secure protocols emerge. **Banking**, after all, has been at the forefront of secure inter-enterprise computing with its electronic funds transfer networks. Quick Response and Efficient Consumer Response systems in the **retail trade** replenish inventory as needed, thereby reducing inventory holding costs and speeding up ordering. Manufacturers are increasingly managing inventory for retailers using third generation systems. In **telecommunications**, Information Builders' EDA/SQL is used by a major telephone company to integrate cellular billing systems from other carriers. In the **health services** market, community networks linking medical practitioners, clinics and hospitals are another fertile area for third generation systems.

Summary

Third generation systems will lead to trading communities that have compatible systems. These communities will be at a competitive advantage as they reduce paperwork, speed up business transactions and reduce time wasting negotiations. Selling and marketing third generation systems requires vendors to cross-train personnel in a variety of technical and business disciplines to succeed.

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Vol. I, No. 6

1995

Firewall Software and Services Market To Reach \$16 Billion By 2000

Firewall Technology

The worldwide firewall software products and services market is growing in excess of 100% this year and the dramatic growth is not expected to slow significantly over the next five years. Firewalls are an essential component of network security. A firewall is a combination of software and hardware used to keep unauthorized individuals from accessing a private network. It is essentially a barrier between an internal network and the Internet.

Companies are building firewalls around their corporate networks to guard against attacks from Internet hackers. Internal firewalls are also being used to protect departments with sensitive information, such as Human Resources and Accounting, from internal users.

The Firewall Market

The market is emerging and fragmented. There are many potential leaders that include systems vendors, software vendors, systems integrators, and network equipment vendors.

The demand for firewalls is widespread because it encompasses all types and sizes of organizations with dedicated Internet access. As commercial Internet use and population

grows geometrically, so too does the firewall market.

A new INPUT report, *Internet Security: The Impact of Firewalls on Client/Server Applications*, examines the motivation for firewalls and how innovative firewall technologies are revolutionizing network security for businesses, government agencies, and universities.

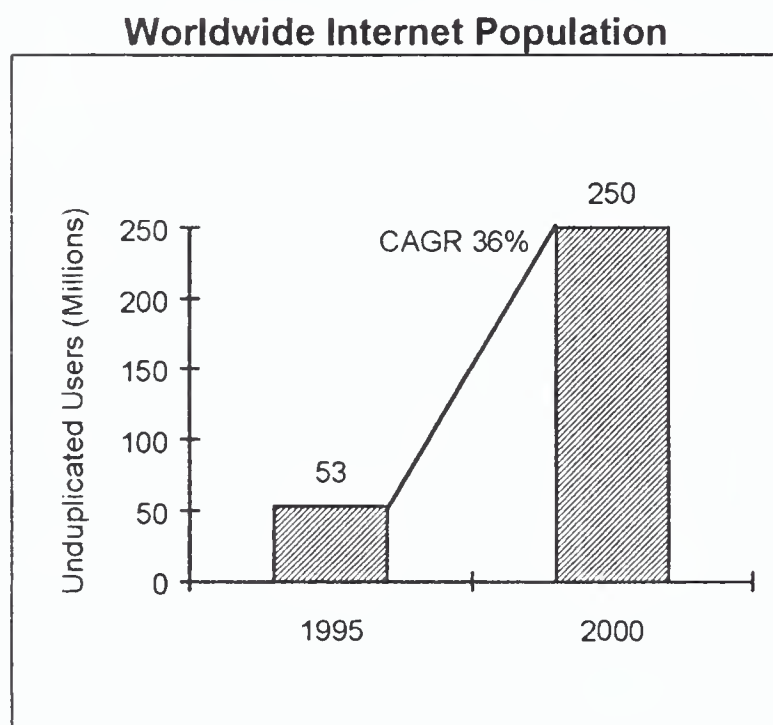
The Environment

The commercial explosion of the Internet, and especially the World Wide Web (WWW), has brought security issues to the forefront for many businesses. As the number of users on the Internet multiplies rapidly, computer security on the Internet is a growing problem. There are several reasons for the Internet's astounding growth:

- Relaxation of restrictions on commercial use
- Implementation of the WWW and software browsers designed to take advantage of the Web
- The amount and variety of information available on the Internet has increased in excess of a hundred times in the last year

As illustrated by Exhibit 1, INPUT expects the worldwide Internet population to grow from 53 million unduplicated users by the end of 1995 to 250 million unduplicated users by 2000, with a compound annual growth rate of 36%.

Exhibit 1



Source: INPUT

The growth of Internet use has spurred a corresponding increase in the number of

people with a detailed technical understanding of Internet protocols and systems. With this technical understanding of the Internet also comes an understanding of the potential vulnerabilities of the Internet infrastructure, which has led to an increase in security incidents.

Types of Firewalls

The two main methods which are currently used to implement firewalls are packet filtering and application-gateways (often called Bastion Hosts). As illustrated by Exhibit 2, both types of firewalls have various strengths and weaknesses. Many companies use a combination of both types of firewalls to create a comprehensive security solution that draws on the strengths of each method.

Exhibit 3 portrays a Bastion Host firewall which combines packet filtering technology and an application gateway. This shows an internal secure LAN connected to the Internet using a firewall host and two packet filters. One packet filter screens attacks from the outside network to the internal one, and the other screens everything sent from the internal network to the outside.

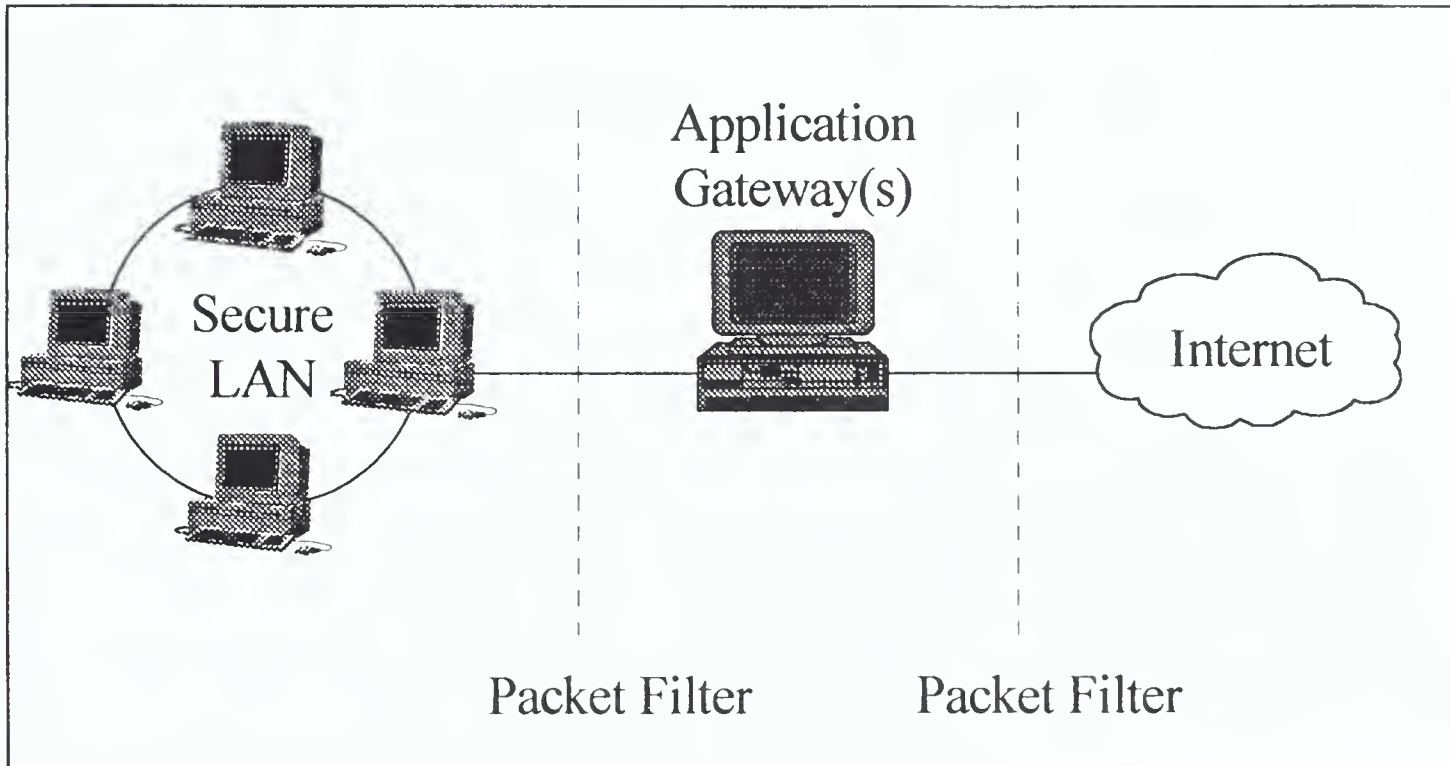
Exhibit 2

Firewall Comparison

Firewall Type	Strengths	Weaknesses
Packet-Filtering	<ul style="list-style-type: none"> • Transparent to users • Comprehensive • Inexpensive 	<ul style="list-style-type: none"> • Only offer moderate security • Low level of protocol understanding • Difficult to configure • Lack auditing mechanisms • Certain services cannot be implemented securely • Limited support of security policies
Application-level	<ul style="list-style-type: none"> • Extensive security • Hides corporate addresses • Ample auditing mechanisms 	<ul style="list-style-type: none"> • Slower • Intrusive • Require extensive customization and modification • Expensive to implement and manage

Source: INPUT

Exhibit 3

A Bastion Host Firewall

Source: INPUT

Firewall Market Forecast

INPUT has developed a worldwide forecast for the firewall software products and services market. The software market forecast includes user expenditures on new software product sales and corresponding spending on maintenance, add-ons and replacement products. The services segment of the market forecast includes expenditure levels for planning and consulting, design and development, implementation, support, and training and education.

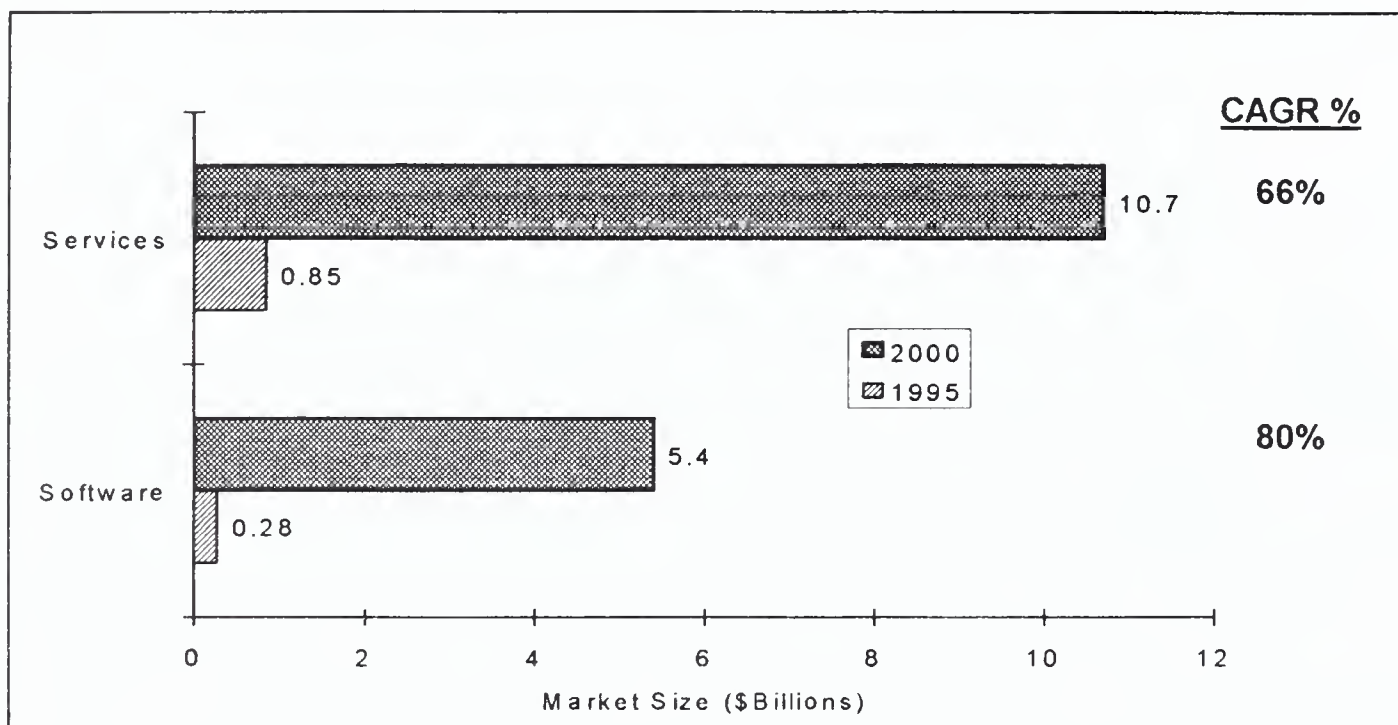
As shown in Exhibit 4, INPUT forecasts the worldwide firewall software product market to grow at a compound annual growth rate (CAGR) of 80% over the next five years and the worldwide firewall services market to grow from \$850 million in 1995 to \$10.7

billion in 2000. INPUT's forecast of the services segment of the firewall market only includes external expenditures. Users will spend a similar amount on internal services, creating a demand for training services.

The U.S. accounts for a high proportion (72%) of the worldwide market because the majority of Internet commercial domains today, are in the U.S. As the number of worldwide unduplicated Internet users increases from 53 million to 250 million over the next five years, the proportion of commercial Internet use outside of the U.S. will increase. By the year 2000 the U.S. will account for only half of the firewall software products and services market.

Exhibit 4

Market for Firewall Software and Services, Worldwide, 1995-2000



Source: INPUT

Conclusions

In the firewall marketplace the only constants are change and double-digit growth. The firewall market is in its infancy. There are no dominant players and there are opportunities for new entrants. With a 70% compound annual growth rate, worldwide, over the next five years, vendors, professional services, and systems integrators should position themselves to take advantage of this marketplace.

The only way for private networks to be completely secure is not to be connected to the Internet. The population of talented computer hackers is on the rise and automated hacker tools are becoming more sophisticated. To

protect private networks companies, government agencies, and universities should establish a high-level of security by developing a comprehensive security policy and a firewall solution.

Users will be faced with significant security-related expenditures to securely connect to the Internet. The costs of security technologies are only a fraction of the total costs that will be incurred. The cost of securing an enterprise's networks includes firewall products and services, training and educating users and IS staff, finding people who have the expertise to set-up and administer security policies, staff to manage the security process, and keeping abreast of the latest security technologies and hacker techniques.

This Research Bulletin is issued as part of INPUT's Client/Server Software Program. If you have questions or comments on this bulletin, please call your local INPUT organization or Robert L. Goodwin at INPUT, 1881 Landings Drive, Mountain View, CA 94043-0848, (415) 961-3300.

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Research Bulletin

A Publication from INPUT's Client/Server Software Program

Vol. III, No. 2

1997

Next Generation of Client/Server Applications Emerging

SmartStream Leads Pack

A number of large software vendors have object-oriented versions of their client/server enterprise applications forthcoming, but Geac SmartStream leads the pack of large vendors, and already offers a next generation HR application. Geac SmartStream has already started to re-architect and migrate their SmartStream application to the Internet platform by using the Java programming language and CORBA IIOP standard, designed to overcome the obstacles of traditional client/server applications.

Second generation client/server systems introduced a middle tier to improve logic reuse and allow users to mix and match different databases. But some logic and data remained on the clients, requiring users to deploy, update and maintain platform-specific, client-side software.

Next generation client/server systems bring the computing world back to the days of mainframe maintenance by eliminating stored client-side software. These applications are developed on a platform which fuses the ease of use and deployment of the Internet with the performance and extendability of today's client/server technologies. As Object Request

Broker (ORB) technology is integrated into Web browsers, next generation applications based on components, such as Java, will begin to replace traditional client/server applications.

These next generation client/server applications promise to lower maintenance and training costs, and support a wider range of distributed clients and servers. Not only do these applications allow companies to extend their reach to customers, suppliers and business partners, but also allow applications to link and interact with other applications and services across corporate boundaries.

Geac SmartStream addresses the requirements for next generation applications and offers flexibility, application, and cost advantages to its customers.

Benefits of Next Generation Applications

The client/server era emerged as a means of addressing the issue of managing desktop systems in an enterprise environment. Traditional client/server systems rely on proprietary network protocols, whereas 3rd generation client/server systems use the open, Internet protocol. Architectural differences of

client/server systems are summarized in Exhibit 1.

The Internet has brought about a revolution in computing and will offer many benefits to users of next generation client/server

applications. Key among these are application flexibility and re-configurability, open application interaction, continuous application enhancement, lower IT costs, and applications that extend beyond the boundaries of the enterprise.

Exhibit 1

Architectural Characteristics of Client/Server Systems

Need	1 st Generation	2 nd Generation	3 rd Generation
Scope	2-tier	3-tier	n-tier
Network protocol	Proprietary	Proprietary	Open (TCP/IP)
Client-side software	Platform-specific	Platform-specific	Platform-independent
User interface	GUI	GUI	Visual objects
Middleware	Stored procedures	ORBs over Proprietary Networks	ORBs over Internet (IIOP)
Re-use of business logic	No	Yes	Yes

Messaging

The crucial piece of distributed object computing which drives both flexibility and scalability is messaging. Through encapsulation the application is shielded from the operating environment and separate discrete business processes from one another.

Each of these processes can run on the same or different platforms and is invoked via a message. Each discrete business process or event can be a client requesting information, a server supplying information, or both to another event.

Scalability

Applications servers built on a distributed and scalable architecture can scale from three-tier environment to an n-tier environment, capable of handling loads required by distributed applications and of optimizing application processing. Third-generation client/server applications also introduce a

middle tier, similar to second-generation applications, which allows users to use any type or combination of standard database solutions.

Hardware Advantages

It is impossible in developing and designing third-generation systems to predict the range of clients or servers likely to be supported over the life of a system. Clients need to be separated from servers. Hence, Internet servers and browsers from companies like Netscape and Open Market are increasingly being used as platforms for third-generation applications.

Servers

Next generation applications utilize distributed servers, upon which reside business applications or objects to be accessed by clients across the Internet. The servers represent a range of price/performance points to be tailored to specific applications, but they share the common features of interfacing with

legacy code and databases and delivering application services to client devices. The term "Application server" is a logical distinction and may be combined with Web or object servers.

Clients

Because applications are independent of the underlying target client device, the same application is dynamically downloadable, without modification, to a broad range of client devices including "smart" telephones, point-of-sale devices, PCs, workstations, Internet appliances, set-top boxes and more. INPUT estimates that over 34% of the client devices purchased by corporations will be Internet appliances or network computers by the year 2000.

This will ensure the widest possible audience for these next generation applications. Next generation applications will allow companies to select the client-side device with the best price/performance for each particular user. And next generation architecture are resilient to changes in underlying hardware and network technologies.

Application Characteristics

With next generation client/server applications, object browsers and cross-platform, architecture-neutral components replace platform-specific, client-side software. Applications are built from components that assemble in real-time at the client device.

These client/server applications offer several advantages over early generation client/server applications.

Open Application Interaction

Managed Interaction with Clients

Next generation applications maintain information about the session with the client and about the client's current state by employing the IIOP over the Internet. They also have a mechanism for managing the

client sessions so that transactions can be completed or rolled back if a client should lose a connection with a server in the middle of a transaction.

Next generation applications allow remote branches and external organizations to connect into mainstream corporate environments. They enhance the ability to further extend their reach to "casual" and traditional end users in and outside of an enterprise.

Interaction with Other Applications

The third-generation is where leading-edge users are able to accelerate processes the most by linking systems across enterprise boundaries.

Third generation client/server applications will provide "plug and play" capabilities with other next generation enterprise systems, or application objects. These applications enable transactions to cross enterprise boundaries and interact with more than one business application, even if they use different underlying object programming languages.

Next generation applications break the enterprise software monopoly model and allow companies to select best-of-breed components to build enterprise solutions

Interaction with Other Services

Third-generation client/server applications can make use of other Internet services available on corporate Intranets.

These services include directory (LDAP), network administration (SNMP), naming such as DNS or common Internet file system (CIFS), security, events and workflow. These services are accessible by objects and allow IT managers to centrally manage enterprise applications.

Self-Service

Next generation applications create a new business paradigm of "self-service", empowering the individual user to perform data processing tasks typically assigned to trained administrative staff.

With object browsers, next generation software will emphasize self service, by extending information and application access and updating capabilities to every employee, supplier, and customer.

Continuous Application Enhancement

Multi-tiered, object-oriented applications allow for fast incremental improvement of software. Next generation applications which utilize object technologies and platform-independent programming infrastructures can easily handle the evolution of a company's business model.

Applications will exist as a set of objects, business rules, and data models in an object repository. These objects, business rules and data models are independent of any specific platform, database, or execution environment. With repositories, users will be able to take advantage of improvements in computing technology without having to re-engineer the application.

Cost Characteristics

Less Maintenance

Client software management is greatly reduced with next generation applications. All code, data and configuration information is stored and managed centrally. Use of other Internet services such as directory, naming and security decreases IT administration costs because individual application preferences are stored centrally.

Another advantage of next generation applications is that there is no need to move desktop computer files when a person is moved. All permanent-state information is maintained in the application server, not on the desktop. Companies are able to swap components in and out of a system to support new hardware, failed client devices, and make business changes.

Less Training

Third generation client/server applications are designed with the Web browsers in mind. Applications that are simply connected to a Web browser do not lend themselves to the Web experience. Applications which fall under this category are re-architected in order to retain the Web format to which users have become accustomed. The familiar Web interface leads to reduced training costs.

They present data in a meaningful, intuitive manner. Users of next generation applications require less training than those using traditional user interfaces.

Conclusion

Next generation applications can provide quantum improvements in enterprise-wide software maintenance and re-usability. It will dominate the future of software services and applications development. Next generation enterprise software will have to be implemented using object technology because current procedural methods and tools cannot support the complexity of the operating system and network management needed to control the infrastructure.

The Internet and object browsers will accelerate the movement towards the use of objects to create network-aware applications that extend beyond the boundaries of the corporation.

This Research Bulletin is issued as part of INPUT's Client/Server Software Program. If you have any questions or comments regarding this bulletin, please contact your local INPUT organization or Gary Lundberg at: INPUT, 1881 Landings Drive, Mountain View, CA 94043-0848, Ph. (415) 528-6341.

